In the Claims

Please amend claims 1, 11, 14, 15 and 21 as follows. Also, the current status for all of the claims are included.

1. (Currently Amended) A method for determining a direction or parallelism of a beam, comprising:

forming a beam which is implanted into a work piece;

forming an adjusted intensity profile from at least a portion of the beam at a first position;

detecting at least one variation in intensity in the adjusted intensity profile independent from said step of creating the adjusted intensity profile downstream of the first position; and

determining a direction or parallelism of the beam while implanting into said work piece relative to a reference direction in response to detecting a distance in at least one dimension between a position where the at least one variation in intensity is detected and the first position where the adjusted intensity profile is formed.

2. (Original) The method of claim 1, wherein the step of forming a beam comprises forming a charged particle beam.

3. (Original) The method of claim 1, wherein the step of forming a beam comprises forming an ion beam for implanting dopant materials into a semiconductor material.

4. (Original) The method of claim 1, wherein the step of forming an adjusted intensity profile comprises blocking a portion of the beam.

5. (Original) The method of claim 1, wherein the step of forming an adjusted intensity profile comprises scanning a detection device in a direction transverse to the beam.

6. (Original) The method of claim 1, wherein the step of forming an adjusted intensity profile comprises:

positioning a detection device in the beam; and

determining a measure of intensity uniformity of the beam.

7. (Previously Presented) The method of claim 1, wherein the step of detecting at least one variation in intensity comprises:

providing at least one detector downstream of the first position; and

detecting a change in beam intensity downstream of the first position with the detector.

8. (Previously Presented) The method of claim 1, wherein the step of detecting at least one variation in intensity comprises:

moving a detector in a direction transverse to the beam direction; and

detecting a change in beam intensity that corresponds to the adjusted intensity profile.

9. (Previously Presented) The method of claim 1, wherein the step of determining a direction or parallelism comprises:

identifying a first position where an adjusted intensity profile that caused a detected minimum intensity was created;

identifying a second position where the minimum intensity is detected; and

determining a direction or parallelism of the beam based on the first and second positions relative to the reference direction.

10. (Previously Presented) The method of claim 1, further comprising:

forming a second adjusted intensity profile from at least another portion of the beam at a second position;

detecting a second variation in intensity of at least another portion of the beam downstream of the second position;

determining a direction or parallelism of the beam based on the positions of the detected intensity profiles relative to the positions of the first and second adjusted intensity profiles.

11. (Currently Amended) A method for determining a direction or parallelism of an ion beam, comprising:

forming an ion beam which is implanted into a work piece;

blocking a portion of the beam with a beam modifier;

identifying a position where a shadow is formed ~~separate~~ independent from and downstream of the beam modifier; and

determining a direction or parallelism of the ion beam while implanting into said work piece in response to detecting a distance between the position of the shadow and the position of the beam modifier.

12. (Original) The method of claim 11, wherein the step of blocking a portion of the beam comprises scanning a beam modifier in a direction transverse to the beam; and

determining a measure of uniformity of the beam.

13. (Original) The method of claim 11, wherein the step of identifying a position comprises:

detecting an intensity profile of the beam; and

determining a position of the beam modifier that corresponds to a detected minimum intensity.

14. (Currently Amended) An apparatus for determining a direction or parallelism of a beam, comprising:

means for forming a beam which is implanted into a work piece;

means for forming an adjusted intensity profile from at least a portion of the beam at a first position;

means for detecting an intensity profile of at least a portion of the beam independent from said means for forming the adjusted intensity profile downstream of the first position at a second position that is variable in distance from the first position in accordance with changes in direction or parallelism of the beam relative to a reference direction; and

means for determining a direction or parallelism of the beam relative to a reference direction while implanting into said work piece in response to detecting a distance between a position of the detected intensity profile and a position where the adjusted intensity profile is formed.

15. (Currently Amended) An apparatus for determining a direction or parallelism of a charged particle beam, comprising:

at least one detector that detects an intensity profile of at least a portion of the charge particle beam which is implanted into a work piece;

a beam modifier that alters an intensity profile of at least a portion of the charged particle beam independent from the at least one detector upstream of the at least one detector; and

a controller that determines a direction or parallelism of the charge particle beam relative to a reference direction while implanting into said work piece in response to a detected distance in at least one dimension between a position where the intensity profile is detected by the at least one detector and a position where the beam modifier created the detected intensity profile.

16. (Original) The apparatus of claim 15, wherein the controller determines a direction or parallelism based on the positions of at least one detector and the beam modifier relative to a reference direction at a point of minimum detected beam intensity.

17. (Original) The apparatus of claim 15, wherein the beam modifier includes a drive system that moves the beam modifier transverse to a path of the charged particle beam.

18. (Original) The apparatus of claim 15, wherein the beam modifier outputs a signal that is used to determine a measure of uniformity of the charged particle beam.

19. (Original) The apparatus of claim 18, wherein two detectors detect an intensity profile of two respective portions of the charged particle beam, and the beam modifier is a Faraday detector moved in a direction transverse to the charged particle beam.

20. (Original) The apparatus of claim 19, wherein the beam modifier is moved in a direction transverse to the beam direction along a workpiece plane.

21. (Currently Amended) An ion beam implantation apparatus comprising:

a charged particle beam generator that generates a charged particle beam;

at least one detector that detects an intensity profile of at least a portion of the charged particle beam which is implanted into a workpiece;

a beam modifier that alters an intensity profile of at least a portion of the charged particle beam independent from the at least one upstream of the at least one detector; and

a controller that determines a direction or parallelism of the charged particle beam relative to a reference direction while implanting into said workpiece in response to a detected distance in at least one dimension between a position where the intensity profile is detected by the at least one detector and a position where the beam modifier created the detected intensity profile.

22. (Original) The apparatus of claim 21, wherein the charged particle beam generator scans the charged particle beam in a direction along at least a portion of a workpiece plane.

23. (Previously Presented) An apparatus for determining a direction or parallelism of a charged particle beam, comprising:

at least one detector that detects an intensity profile of at least a portion of the charge particle beam which is implanted into a work piece;

a beam modifier that alters an intensity profile of at least a portion of the charged particle beam upstream of the at least one detector; and

a controller that determines a direction or parallelism of the charge particle beam relative to a reference direction while implanting into said work piece in response to a detected distance in at least one dimension between a position where the intensity profile is detected by the at least one detector and a position where the beam modifier created the detected intensity profile;

wherein the at least one detector includes at least three detectors and the controller determines a direction or parallelism of the charged particle beam in three dimensions relative to the reference direction.

24. (Previously Presented) The apparatus of claim 15, wherein the direction or parallelism is determined based on detections of intensity profiles at a plurality of different positions.

25. (Currently Amended) A method for determining a direction or parallelism of a beam, comprising:

forming a beam which is implanted into a work piece;

at a first beamline location, modifying the beam to produce a modified intensity profile having a spatial intensity variation;

at a second beamline location downstream of the first beamline location, detecting the spatial intensity variation in the modified intensity profile independent fro the steps of modifying the beam; and

determining a beam direction or parallelism while implanting into said work piece based on relative positions of the spatial intensity variation in the modified intensity profile at the first and second beamline locations.